LIFE CYCLE OF A HYDROZOAN, CAMPANULINA TYPE OR AEQUOREA COERULESOENS BRANDT

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LIFE CYCLE OF A HYDROZOAN, *CAMPANULINA* TYPE OR *AEQUOREA COERULESCENS* BRANDT[1)]

By

YOSHIKO KAKINUMA

柿沼好子

Marine Biological Station of Asamushi, Tôhoku University, Aomori City, Japan

The colonies with medusa buds of *Campanulina* type were found on the surface of the tubes of *Pseudopotamilla occelata* Moore which were cultivated in a glass aquarium of the circulation system (sea water temperature 10°C) in the laboratory, on the 10th of March 1965. In the filed, sometimes the colonies were found attached on small seaweeds growing on the seashore in front of the Station. The life cycle of this species is described in the present paper.

Before going further, the writer thanks Dr. Prof. Eturô Hirai, Director of the Marine Biological Station of Asamushi for his supervision during the course of her investigation.

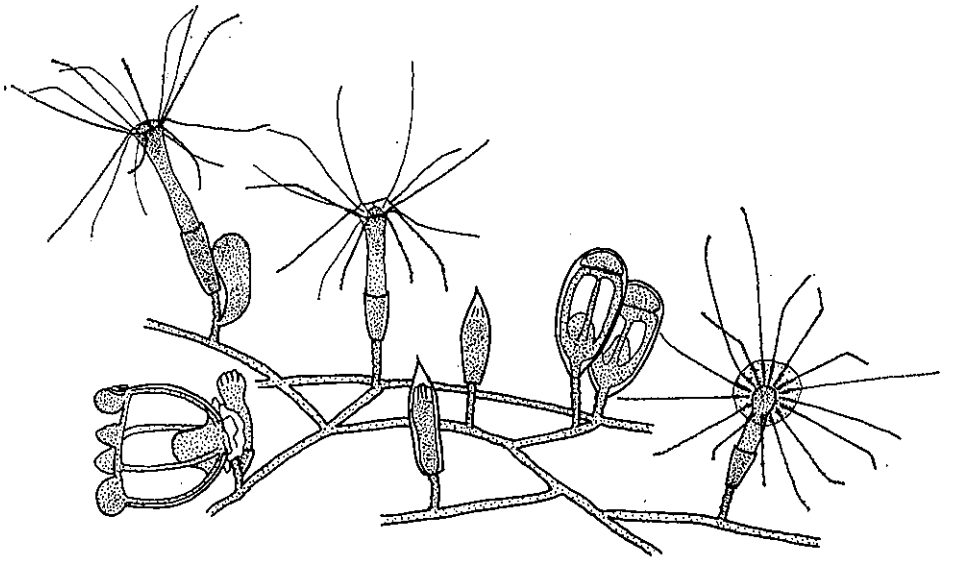

Fig. 1. A hydroid colony of *Campanulina* type, with medusa buds, and a medusa to be liberated with a ruptured enveloping sheath.

1) Contributions from the Marine Biological Station of Asamushi, Aomori Ken, No. 332

DESCRIPTION

Rearing of Material: The colonies can be kept throughout the year in a glass aquarium of the circulation system by regulating the sea water temperature at 15°C. When they are kept in dishes, they easily degenerate in the sea water, therefore the colonies must be provided every day with an adequate supply of fresh sea water. The favourable temperature for the growth of the colony is 15°C to 20°C, and the larvae of the brine shrimp serve as the food.

Life cycle: Colonies of single hydranths reach a height of 1 mm. to 2,5 mm. and rise from a creeping stolon (Fig. 1) (Pl. I, 1). The hydranth is colorless and has a single whorl of 16 to 20 radially arranged tentacles which are united for about one-tenth of their length by a basal membranous web. This web usually contained bean-shaped nematocysts approximately 0,01 to 0,015mm. in length (Fig. 2) (Pl. I, 2, 3). The hydrotheca is one-third the length of the hydranth, cylindrical, and tapering to a not so distinct toothed opercular point. Its base is at right-angles to a lateral wall (Pl. I, 4). Fine longitudinal striations are visible on the hydrotheca. The hydrocaulus is about 0,2 to 1 mm. long and imperfectly annulated throughout its length. The gonophore is large and cylindrical, arising from a hydroculus on the imperfectly annulated short stem just below the hydranth, or arising from the hydrorhyza directly (Fig. 3) (Pl. I, 5). A gonotheca contains

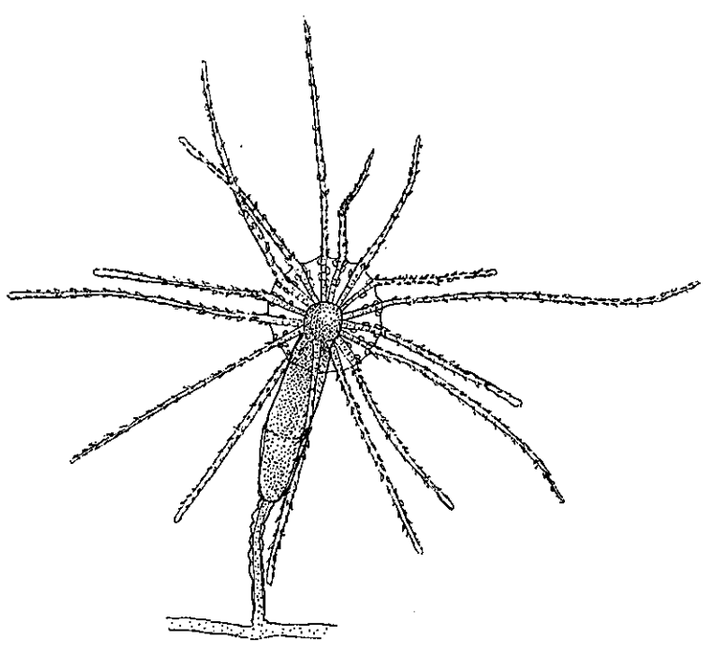

Fig. 2. A fully developed polyp.

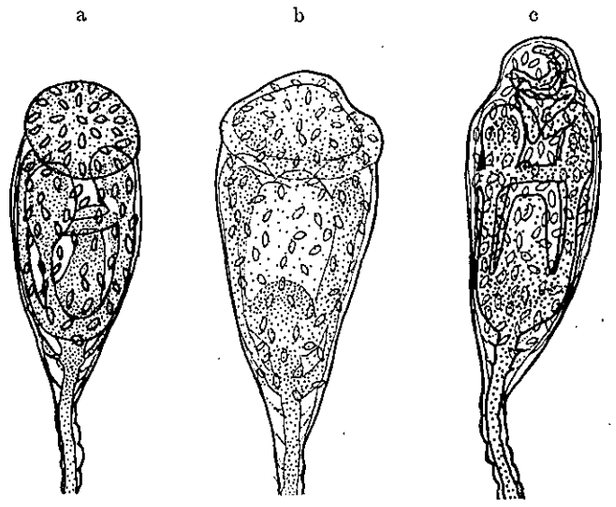

Fig. 3. Three stages in the growth of the medusa buds. a and b; Younger ones. c; Just before the rupture of the sheath.

one medusa bud.

The colonies grow more luxuriantly on a piece of cloth of polyethylene-glycohol than in the petri dishes in the laboratory. About five days after the transference of the initial polyp, a rudiment of the first bud of the hydranth was observed. The rudiment of the hydranth was of globular shape at first, and three days later the bud developed short tentacles. The hydranth was armed with longitudinal folds of the hydrotheca (Fig. 4). Five days later, it had grown completely. Then after about a day, the hydranth became elongated with the opened long tentacles extending from the hydrotheca proximally.

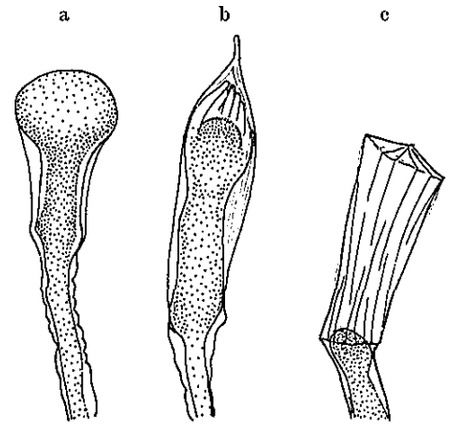

Fig. 4. a and b show the developing hydranth, and c shows the hydroid theca after the degeneration of a hydranth.

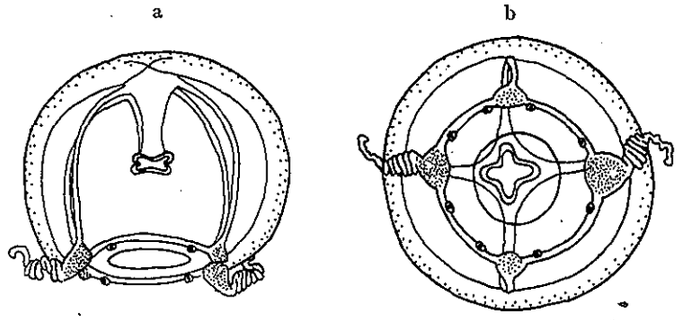

Fig. 5–9. The growth of the medusa of *Aequorea coerulescens* Brandt.
Fig. 5. Newly liberated medusa. a; side view :b Oral view

The newly liberated medusa is of bell shape (Fig. 5) (Pl. I, 6, 7). It is about 1 mm. in both height and diameter. The jelly is moderatly thick and has a slight depression at the apex. There are small nematocysts scattered over the whole exumbrella. The velum is broad. The stomach is half the height of the bell and quadrangular in cross section. The manubrium has four cruciform lips. The four radial canals and ring canal are narrow. There are two opposite perradial tentacles with elongated bulbs and another two opposite smaller perradial bulbs without tentacles. There are eight adradial marginal vesicles, each containing one or two concretions. Every pair of them is situated upon the bell margin near the base of each tentacle. The perradial tentacle bulbs and the ring canal are plae orange in color, and the tentacle, stomach and manubrium are milky white in color, where as the other parts are colorless. When the medusa was reared in a large dish for seven days at 15°C to 18°C room temperature, the umbrella became somewhat higher than the width and had a thick gelatinous

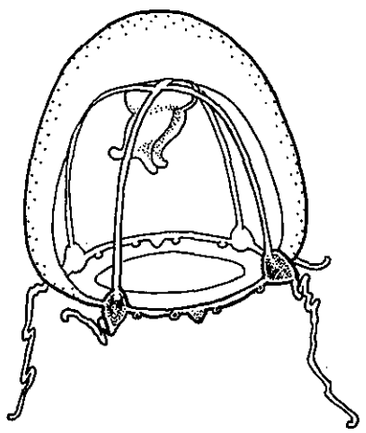

Fig. 6. Seven days old medusa.

center (Fig. 6). The tentacles appeared on the two perradial bulbs which had no tentacles in the younger medusa stage. About ten days later, the medusa was 3-4 mm. in diameter, the rudimental new four radial canals increased in size between the primary four radial canals from the stomach margin growing outwards, and the rudiments of the new four marginal tentacle bulbs appeared on each inter-radius respectively (Fig. 7). The stomach became orange, the outside of

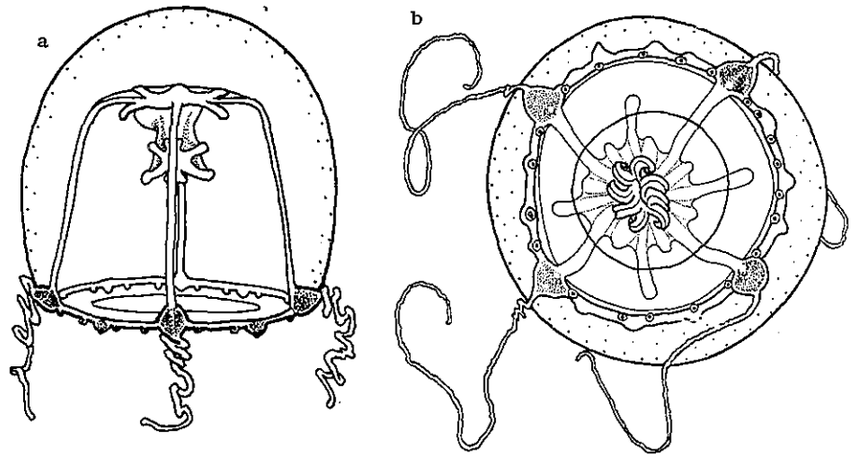

Fig. 7. Ten days old medusa. a; Side view b: aoral view

the perradial tentacle bulbs became violet, and the manubrium and a ring canal became fluorescent green in color. Two weeks later, when the medusa was 7–8mm. in diameter, the umbrella became higher, and the rudiments of the additional four interradial canals elongated to reach completely to the bell margin (Pl. II, 8). The small interradial tentacles appeared on the interradial tentacle bulbs. At the same stage eight adradial vesicles were added. The lips increased twice the number of the original four perradial lips. Three weeks later, when the medusa was about 10 mm. in diameter, the umbrella became somewhat flatter than the higher hemisphere and had a thick gelatinous center and thinner margin, and 16 rudiments of the adradial marginal tentacles appeared (Fig. 8). The colorless primary marginal bulbs turned to bright organe, but contained black granules. Four weeks later, the medusa was about 15 mm. in diameter (Pl. II. 9). Thirty-two radial canals were counted. The stomach became wide and shallow, and its diameter attained about one-thrid that of the umbrella. The mouth-opening was surrounded by 16 small lappets. Five weeks later, the tentacles increased to about 60 in number but the radial canal did not increase any more (Fig. 9). After this stage the tentacles developed irregularly. About two months later, the medusa reached 25 mm. in diameter (Pl II, 10). At a diameter of 30 mm., when

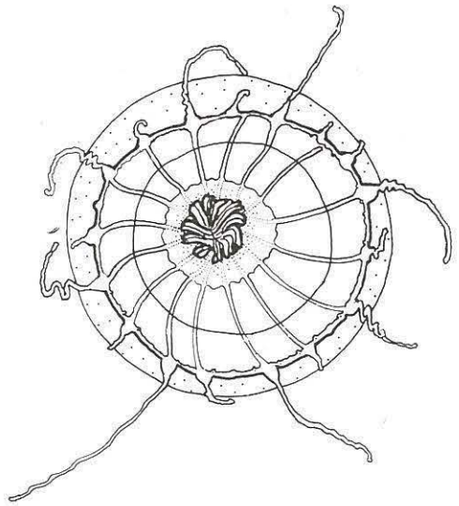

Fig. 8. Three weeks old medusa.

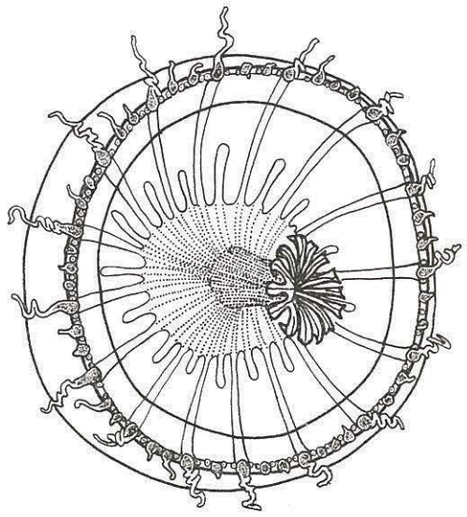

Fig. 9. Five weeks old medusa.

two months and a half elapsed, there were 32 radial cnals and about 120 tentacles (Pl. II. 11.) The mouth with 16 lips was opend widely and was about one-thrid as wide as the bell diameter at the mouth base. In this stage, it was found that the linear gonad began to develop along almost the whole length of each radial canal. One or two of the numerous statocysts were situated between each tentacle on the bell margin. The tetnacles became blue in color but were surrounded outside by blue black granules.

The medusa, *Aequorea coerulescens* Brandt was described by Uchida, in 1927, from Mutsu Bay. The medusae of this species is rather common and has been found from the spring to the summer every year, where as the other species of *Aequorea* type medusa has never been found in the bay.

The species investigated in the present study is identified as *Aequorea coerulescens*. The polyp or life cycle of this species had remained unknown to date.

SUMMARY

A hydrozoan colony of *Campanulina* type was cultivated in the laboratory and the development of the medusa for two and a half months was investigated. The present species is identified as *Aquorea coerulescens* Brandt, and the life cycle is described for the first time in this paper.

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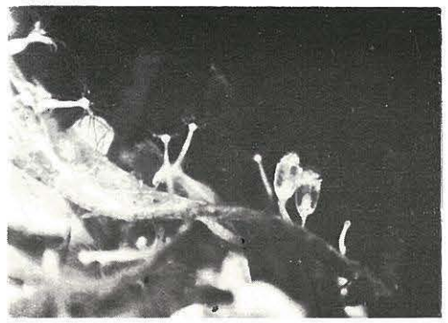
Uchida, T. 1927. Report of biological survey of Mutsu Bay. 2. Medusa of Mutsu Bay. Sci. Rep. Tôhoku Imp. Univ., Biology. 2: 222-224.



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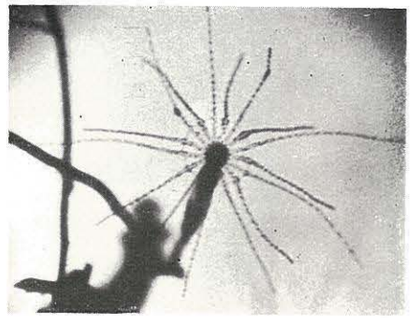

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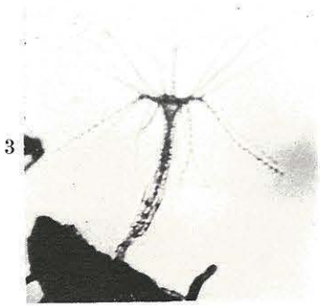

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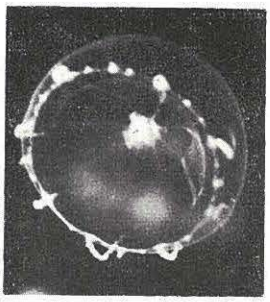
Pl. I Life cycle of *Aequorea coerulescens* Brandt

1. A hydroid colony of *Campanulina* type.
2. and 3. A fully developed hydranth.
4. Side view of a hydranth base which is at right-angle to the lateral wall.
5. Late stage of the gonophore arising from a hydrocaulus
6. Oral view of two days old medusa.
7. Side view of the medusa shown in Pl. 1, 6.

Y. Kakinuma: Life cycle of *Aequorea coerulescens*



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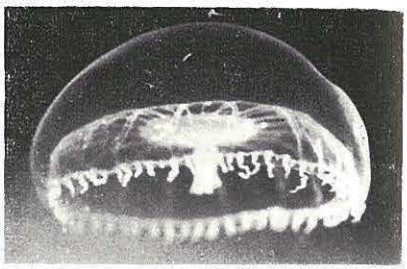

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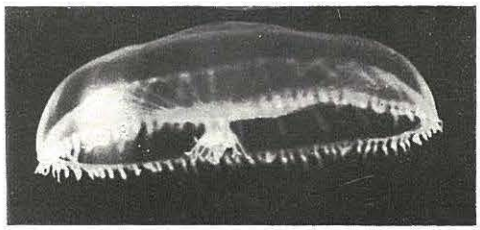

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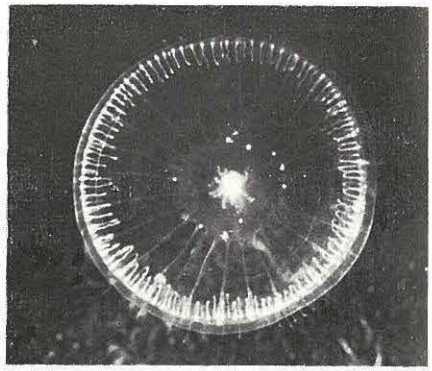

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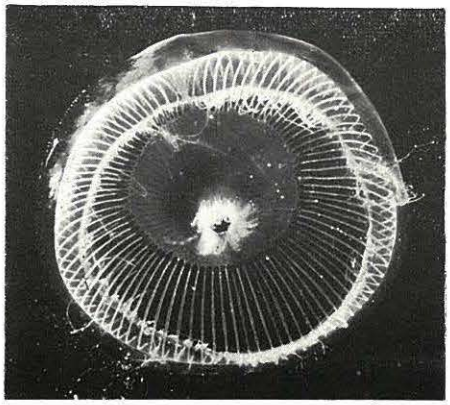

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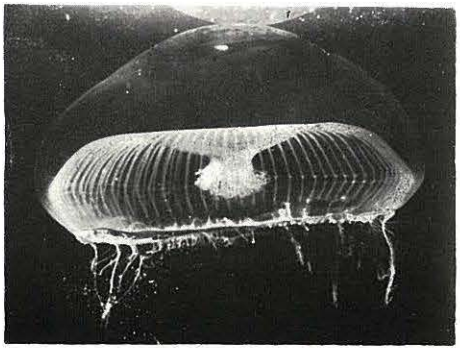

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Pl. II. 8-11 The growth of the medusa of *Aequorea coerulescens* Brandt

8. Two weeks old medusa.
9. Four weeks old medusa.
10. Oral view of about two months old medusa.
11. Side view fo about two months and a half old medusa.
12. *Aequorea coerulescens* Brant which was collected near the Station. Oral view of adult medusa, about 100 mm. in diameter.
13. Side view of the meduea shown in Pl. II, 12.

Y. KAKINUMA: Life cycle of *Aequorea coerulescens*